

WHAT IS CLAIMED IS:

- 1 1. A method for interfacing with device hardware supporting a plurality of
2 devices comprising:
 - 3 initializing a device interface driver to represent the device hardware as a virtual
4 bus to an operating system and to represent to the operating system each device supported
5 in the device hardware as a device attached to the virtual bus;
 - 6 initializing the device hardware;
 - 7 accessing the device hardware to determine devices supported by the device
8 hardware;
 - 9 generating one device object for each determined device supported by the device
10 hardware, wherein each generated device object represents the determined device to the
11 operating system; and
 - 12 reporting the determined devices to the operating system, wherein the operating
13 system loads a device driver for each of the reported devices supported by the device
14 hardware.
- 1 2. The method of claim 1, further comprising:
 - 2 reporting to the operating system that the determined devices are dependent on the
3 virtual bus, wherein in response to being notified that the determined devices and virtual
4 bus are dependent, the operating system will not remove the device interface driver
5 representing the virtual bus until the device drivers associated with the determined
6 devices are removed.
- 1 3. The method of claim 1, further comprising:
 - 2 reporting to the operating system that a power state of the virtual bus represented
3 by the device interface driver cannot be altered until all the device drivers representing
4 devices attached to the virtual bus have their power state similarly altered.
- 1 4. The method of claim 1, wherein the hardware device comprises a network
2 adaptor and wherein each device available in the network adaptor supports a protocol
3 engine for different communication protocols.

1 5. The method of claim 4, wherein each protocol engine processes packets
2 according to a communication protocol and a network protocol, wherein each transport
3 engine supports a different communication protocol and uses a same network protocol.

1 6. The method of claim 1, further comprising:
2 receiving a packet from one device driver;
3 determining a device queue in the device hardware queuing packets for the device
4 supported by the device hardware corresponding to the device driver; and
5 writing the received packet to the determined queue.

1 7. The method of claim 1, further comprising:
2 receiving notification from the device hardware concerning transmission of one
3 packet;
4 determining the device driver for the device in the network adaptor that processed
5 the packet; and
6 transmitting notification to the determined device driver indicating the
7 notification received from the device hardware.

1 8. The method of claim 1, further comprising:
2 receiving indication of a packet provided by the device hardware;
3 determining the device driver for the device supported by the network adaptor that
4 processed the provided packet;
5 invoking a call to cause the determined device driver to process the provided
6 packet.

1 9. The method of claim 1, wherein all the device drivers access devices
2 supported by the device hardware through the device interface driver.

1 10. The method of claim 1, wherein the devices determined to be available in
2 the device hardware comprise less than all the devices supported by the device hardware.

1 11. The method of claim 1, further comprising:

2 in response to detecting a change in the configuration of devices supported by the
3 device hardware, signaling the operating system of the changed configuration of devices
4 available in the device hardware, wherein the operating system is capable of loading or
5 unloading device drivers to support the changed configuration of devices available in the
6 device hardware.

1 12. The method of claim 1, wherein the operations of initializing the device
2 hardware, accessing the device hardware to determine devices supported by the device
3 hardware, generating the device objects, and reporting the determined devices to the
4 operating system are performed by the device interface driver.

1 13. The method of claim 1, wherein one device includes a protocol engine
2 supporting the iSCSI protocol and TCP protocol, wherein one device includes a protocol
3 engine supporting an offloaded LAN protocol, and wherein one device includes a
4 protocol engine supporting non-offloaded-LAN protocol.

1 14. A system, comprising:

2 a processor;
3 an operating system executed by the processor; ✓
4 a network adaptor supporting a plurality of devices;
5 a device interface driver that represents the network adaptor as a virtual bus to the
6 operating system, and that represents to the operating system each device supported in the
7 device hardware as a device attached to the virtual bus, wherein the processor, when
8 executing the device interface driver, is enabled to:

9 (i) access the network adaptor to determine devices supported by the
10 network adaptor;
11 (ii) generate one device object for each determined device supported by
12 the network adaptor, wherein each generated device object represents the
13 determined device to the operating system; and

1 15. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 report to the operating system that the determined devices are dependent on the
4 virtual bus, wherein in response to being notified that the determined devices and virtual
5 bus are dependent, the operating system will not remove the device interface driver
6 representing the virtual bus until the device drivers associated with the determined
7 devices are removed.

1 16. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 report to the operating system that a power state of the virtual bus represented by
4 the device interface driver cannot be altered until all the device drivers representing
5 devices attached to the virtual bus have their power state similarly altered.

1 17. The system of claim 14, wherein each device available in the network
2 adaptor supports a protocol engine for different communication protocols.

1 18. The system of claim 17, wherein each protocol engine processes packets
2 according to a communication protocol, wherein each protocol engine supports a
3 different communication protocol and uses a same network protocol.

1 19. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 receive a packet from one device driver;

determine a device queue in the network adaptor queuing packets for the device supported by the hardware device corresponding to the device driver; and

6 write the received packet to the determined queue.

1 20. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 receive notification from the network adaptor concerning transmission of one
4 packet;

5 determine the device driver for the device in the network adaptor that processed
6 the packet; and

7 transmit notification to the determined device driver indicating the notification
8 received from the device hardware.

1 21. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 receive indication of a packet provided by the network adaptor;

4 determine the device driver for the device supported by the network adaptor that
5 processed the provided packet;

6 invoke a call to cause the determined device driver to process the provided packet.

1 22. The system of claim 14, wherein all the device drivers access devices
2 supported by the network adaptor through the device interface driver.

1 23. The system of claim 14, wherein the devices determined to be available in
2 the network adaptor comprise less than all the devices supported by the network adaptor.

1 24. The system of claim 14, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 signal the operating system of the changed configuration of devices available in
4 the device hardware in response to detecting a change in the configuration of devices
5 supported by the device hardware, wherein the operating system is capable of loading or
6 unloading device drivers to support the changed configuration of devices available in the
7 device hardware.

1 25. The system of claim 14, wherein one device includes a protocol engine
2 supporting the iSCSI protocol and TCP protocol, wherein one device includes a protocol
3 engine supporting an offloaded LAN protocol, and wherein one device includes a
4 protocol engine supporting non-offloaded-LAN protocol.

1 26. A system in communication with a network, comprising:
2 a processor;
3 an operating system executed by the processor;
4 a network adaptor supporting a plurality of devices;
5 at least one physical interface included in the network adaptor enabling
6 communication of packets between the devices and the network, wherein the at least one
7 physical interface is capable of interfacing with copper wires.

8 a device interface driver that represents the network adaptor as a virtual bus to the
9 operating system, and that represents to the operating system each device supported in the
10 device hardware as a device attached to the virtual bus, wherein the processor, when
11 executing the device interface driver, is enabled to:

12 (i) access the network adaptor to determine devices supported by the
13 network adaptor;

14 (ii) generate one device object for each determined device supported by
15 the network adaptor, wherein each generated device object represents the
16 determined device to the operating system; and

17 (iii) report the determined devices to the operating system, wherein the
18 operating system loads a device driver for each of the reported devices supported
19 by the network adaptor, and wherein to the operating system each determined
20 device is considered attached to the virtual bus.

1 27. The system of claim 26, wherein the processor, when executing the device
2 interface driver, is further enabled to:

3 report to the operating system that the determined devices are dependent on the
4 virtual bus, wherein in response to being notified that the determined devices and virtual
5 bus are dependent, the operating system will not remove the device interface driver

6 representing the virtual bus until the device drivers associated with the determined
7 devices are removed.

1 28. An article of manufacture for interfacing with device hardware supporting a
2 plurality of devices, wherein the article of manufacture causes operations to be
3 performed, the operations comprising:

4 initializing a device interface driver to represent the device hardware as a virtual
5 bus to an operating system and to represent to the operating system each device supported
6 in the device hardware as a device attached to the virtual bus;

7 initializing the device hardware;

8 accessing the device hardware to determine devices supported by the device
9 hardware;

10 generating one device object for each determined device supported by the device
11 hardware, wherein each generated device object represents the determined device to the
12 operating system; and

13 reporting the determined devices to the operating system, wherein the operating
14 system loads a device driver for each of the reported devices supported by the device
15 hardware.

1 29. The article of manufacture of claim 28, wherein the operations further
2 comprise:

3 reporting to the operating system that the determined devices are dependent on the
4 virtual bus, wherein in response to being notified that the determined devices and virtual
5 bus are dependent, the operating system will not remove the device interface driver
6 representing the virtual bus until the device drivers associated with the determined
7 devices are removed.

1 30. The article of manufacture of claim 28, wherein the operations further
2 comprise:

3 reporting to the operating system that a power state of the virtual bus represented
4 by the device interface driver cannot be altered until all the device drivers representing
5 devices attached to the virtual bus have their power state similarly altered.

1 31. The article of manufacture of claim 28, wherein the hardware device
2 comprises a network adaptor and wherein each device available in the network adaptor
3 supports a protocol engine for different communication protocols.

1 32. The article of manufacture of claim 31,, wherein each protocol engine
2 processes packets according to a communication protocol and a network protocol,
3 wherein each transport engine supports a different communication protocol and uses a
4 same network protocol.

1 33. The article of manufacture of claim 28, wherein the operations further
2 comprise:
3 receiving a packet from one device driver;
4 determining a device queue in the device hardware queuing packets for the device
5 supported by the device hardware corresponding to the device driver; and
6 writing the received packet to the determined queue.

1 34. The article of manufacture of claim 28, wherein the operations further
2 comprise:
3 receiving notification from the device hardware concerning transmission of one
4 packet;
5 determining the device driver for the device in the network adaptor that processed
6 the packet; and
7 transmitting notification to the determined device driver indicating the
8 notification received from the device hardware.

1 35. The article of manufacture of claim 28, wherein the operations further
2 comprise:

3 receiving indication of a packet provided by the device hardware;
4 determining the device driver for the device supported by the network adaptor that
5 processed the provided packet;
6 invoking a call to cause the determined device driver to process the provided
7 packet.

1 36. The article of manufacture of claim 28, wherein all the device drivers
2 access devices supported by the device hardware through the device interface driver.

1 37. The article of manufacture of claim 28, wherein the devices determined to
2 be available in the device hardware comprise less than all the devices supported by the
3 device hardware.

1 38. The article of manufacture of claim 28, wherein the operations further
2 comprise:

3 in response to detecting a change in the configuration of devices supported by the
4 device hardware, signaling the operating system of the changed configuration of devices
5 available in the device hardware, wherein the operating system is capable of loading or
6 unloading device drivers to support the changed configuration of devices available in the
7 device hardware.

1 39. The article of manufacture of claim 28, wherein the operations of
2 initializing the device hardware, accessing the device hardware to determine devices
3 supported by the device hardware, generating the device objects, and reporting the
4 determined devices to the operating system are performed by the device interface driver.

1 40. The method of claim 28, wherein one device includes a protocol engine
2 supporting the iSCSI protocol and TCP protocol, wherein one device includes a protocol
3 engine supporting an offloaded LAN protocol, and wherein one device includes a
4 protocol engine supporting non-offloaded-LAN protocol.